been detected by Laplace's commentators, but the secular acceleration occupies quite a distinct position. It must be remembered that the calculations of Laplace appeared to render a physical explanation of a remarkable phenomenon. But when this calculation was shown to be seriously wrong, it followed that the cause of the secular acceleration conjectured by Laplace was inadequate to explain the observed facts. The labours of Adams thus reopened the breach between the observations and the theory. The variations in the eccentricity of the earth's orbit will account for part of the secular acceleration. The other part has to be accounted for in a different way. The theory of the tides seems to offer an explanation of the discrepancy. Owing to their incessant action the period of the diurnal rotation has been slightly elongated, and this effect, when duly taken account of, seems to remove the margin between the theoretical and observed values of the secular acceleration. This margin has indeed a singular interest in the recent theory of tidal evolution, inasmuch as it affords us the only measurable indication we have of the effect of tides on the earth's rotation.

The splendid shower of shooting-stars that occurred in November 1866 fixed the attention of astronomers on every part of the theory of these bodies. We were thus taught much concerning them, but for one of the most recondite parts of their theory we are indebted to the labours of Prof. Adams. It had been known that the great displays of the Leonids (for so these shooting-stars are called) take place every thirty-three years. From the year 902 down to the year 1866 many of the successive thirty-three-year periods witnessed the great shower, and records of a considerable number have been handed down to us.

These minute bodies must revolve around the sun, each pursuing its orbit in accordance with the laws of Kepler. It became of interest to find the size and shape of this orbit, as well as its position. Certain features of the orbit are readily determined. The recurrence of the shower on a particular day of the year gives one point in the path of the meteors. The direction of the radiant gives a tangent to that path, and therefore its plane. The sun, of course, lies at the focus, and only a single further element—the periodic time—is requisite to complete our knowledge of the orbit. We are indebted to Prof. H. Newton, of Yale, for his careful discussion of this subject. He had shown that the choice of possible orbits was limited to five. There was first the great oval orbit, in which we now know the meteors do revolve every $33\frac{1}{4}$ years. There was next a nearly circular orbit, with a periodic time a little more than a year; another similar orbit, in which the periodic time would be a few days short of a year; and there were also two other smaller orbits. Prof. Newton had also indicated a method by which it would be possible to discriminate the true orbit as one of these five. The mathematical difficulties of this method were no doubt great, but they did not baffle Prof. Adams.

In the *Monthly Notices* for April 1867, p. 247, will be found the paper in which he announced his solution of the problem. The orbit of the meteors is not fixed, but every time the great swarm comes round, the node is found to be 29 further on in the direction of motion. The effect of this is shown in the gradual alteration of the date of recurrence of the shower. The only influence known to us which could account for this change of the plane, is the attraction of the other planets. The problem, then, may be placed in this shape. A certain specific amount of change of the node takes place. The theoretical change can be computed for all the five different orbits, and Prof. Adams undertook to find it. The difficulty principally arises from the high eccentricities of some of the orbits, which rendered the more familiar methods of calculation inapplicable. After many months of labour, Prof. Adams, aided by his assistants in the Cambridge Observatory, completed his work. He showed that if the meteors revolved in the large orbit with the periodic time of $33\frac{1}{4}$ years, the perturbations of Jupiter would account for a change to the extent of 20′. The attraction of Saturn would augment this by 7′, and Uranus would add 1′, the effect of the earth and the other planets being insensible. The joint effect is thus 28′, which may be regarded as practically coincident with the observed value determined by Prof. Newton. The great orbit was thus a possible path for the meteors, but to complete his discovery Adams had to show that neither of the other four orbits could experience the same perturbation. This, too, he succeeded in demonstrating: he showed that in no one of the other orbits could the change exceed 12′. Thus the orbit of the Leonids was discovered.

Those tremendous powers of calculation which have been exercised on the heavenly bodies with such signal results have also been occasionally applied in various other directions. The discoverer of Neptune has found relaxation from the labours of physical astronomy by little calculations on which we must gaze with astonishment. He has had the curiosity to compute the sums of the reciprocals of the first thousand numbers to 260 places of decimals. We have such confidence in the accuracy of Prof. Adams that we have not thought it necessary to repeat this calculation! He has also taken the trouble to calculate thirty-one of Bernouilli's numbers beyond the point that previous calculators had attained, and he has expressed each of them both as vulgar fractions and as decimals. The sixty-second Bernouilli, the last computed by Adams, runs to 111 places, where fortunately for astronomy the appearance of a recurring figure has terminated this inquiry.

Need it be added that on Prof. Adams every honour which science can bestow has been conferred. We have now the pleasure of enriching our list of Scientific Worthies by the addition of his portrait. R. S. B.

THE BRITISH MUSEUM BIRDS

Catalogue of the Birds in the British Museum. Vol. XI. Fringilliformes: Part II. Containing the Families *Cœrebidæ*, *Tanagridæ*, and *Icteridæ*. By Philip Lutley Sclater. (London: Printed by order of the Trustees. 1886.)

DR. GÜNTHER and the authorities of the Natural History Department of the British Museum are to be congratulated, first, on having sought, and next on having secured, the services of Mr. Sclater for the execution of the eleventh volume of their "Catalogue of Birds." The principal group of which it treats is one that has been, for five-and-thirty years or more, the favourite subject of his study, and indeed there are people who hardly hesitate to assert that the final cause of the existence of the family *Tanagridæ* must have been to find occupation for that gentleman's ingenuity in discriminating, describing, and disposing its members.

In consequence of this the present volume of this "Catalogue" appears as a finished piece of work. Whatever may have been the faults of the plan on which the whole was designed, here its defects are reduced to a minimum, so that few are made manifest. The relationship of the *Cœrebidæ* to the *Tanagridæ* is outwardly pretty close, and there is as yet no indication that future research into their inward structure is likely to separate them more widely, though in the existing state of ornithotomical study it would not be safe to say more. Granting, then, as Mr. Sclater considers, that the former of these families is so nearly allied to the latter that "it is indeed somewhat difficult to separate them by external characters," the comprehension of these two groups in one and the same volume is a very natural proceeding. As regards the third family, *Icteridæ*, associated with them on the present occasion, opinions may reasonably differ. Mr. Sclater confesses himself open to doubt on this point; and, if he does so, a slight amount of agnosticism may be pardoned in others who know not one-half so much about them as he does. Possibly if he had referred to some remarks of Prof. Parker's (*Trans. Zool. Soc.*, x., pp. 266, 267) on the relations of this group, the matter might have seemed to him a little clearer. Mr. Sclater's belief is that, since these birds "present many points of alliance with" the *Sturnidæ*, *i.e.* the true Starlings of the Old World, it would therefore be better "to place them *after* the *Fringillidæ*." Now the multitude of "points of alliance" is perhaps rather apparent than real, and though Prof. Parker considers (*loc. cit.*) that the *Icteridæ* and *Sturnidæ* cannot be "considered to be unrelated," he also shows that the former have nearer allies in their own part of the world. But this by the way. It is more important to inquire in what sense the word "*after*" is used by Mr. Sclater in the passage just quoted. We may be sure that he does not entertain a notion of the possibility of deploying any part even of the animal kingdom in a straight line, as was of old time thought not only possible but expedient; for such a notion would be completely at variance with the doctrine of evolution, which he of course holds. If the word "after" is merely intended to refer to the purely arbitrary arrangement followed, or to be followed, in the "Catalogue," it signifies nothing, and we have no cause to complain. Again, if "after" is to be understood in the sense of "inferior to," then we should wholly agree with him. But if the procession of forms be contrariwise arranged—there being no evidence in this volume to show whether this is so or not—and by the word "after" a later and consequently higher or more specialised type be indicated, then we should, with all deference, beg leave to demur to the supposition. Whatever be the rank and proper place among the true *Passeres* of the *Fringillidæ*—and Dr. Stejneger has lately propounded the view that theirs is the highest—the fact should always be remembered that the so-called *Fringillidæ* of many systematists certainly contain at least two groups, which in their more advanced stages can, so Prof. Parker tells us, be always discriminated. These two groups are the Finches proper and the Buntings, which last several taxonomers have recognised as forming a family, *Emberizidæ*, equal in value to the restricted *Fringillidæ*. Now Prof. Parker has shown that it is to the *Emberizidæ* rather than to these *Fringillidæ* that the *Icteridæ* are allied, and it therefore becomes important to determine the limits of the *Emberizidæ*, which, owing to the want of anatomical or morphological research, is admittedly hitherto a matter of guesswork. In regard to those members of the former which belong to the Old World, or are common to it and to the New World, no difficulty has as yet presented itself. It is in the New World alone that the doubtful forms exist; but even of some genera peculiarly American—*Phrygilus*, for example, as proved by Prof. Parker—indication is not wanting; and if we might hazard a supposition on the subject, it would seem on several grounds more likely that a closer alliance should be shown to exist between the *Icteridæ* and the *Emberizidæ* than between the latter and the true *Fringillidæ*.

From what has been submitted in the foregoing sentences, those who can "read between the lines" may perceive that underneath the points just touched upon is a question of much greater significance than is ordinarily presented by matters of mere taxonomy—especially of the taxonomy of a group of birds so homogeneous as are the *Passeres*. It is undeniable that the American forms of this multitudinous and confessedly highest group of birds (with the exception of those which, being so closely related to the Old-World forms may be not unreasonably supposed to be their derivatives) show a great preponderance of the weaker and, morphologically speaking, lower types. It is in the New World, and especially in South America, that we find all the *Tracheophonæ* and a majority of the different groups of *Oligomyodi*.[1] We can hardly doubt that these are as nearly autochthonous as any groups which now exist; that is to say, they had their origin on land which is now represented by the American continent. Though analogy is often a deceitful guide, it does not seem irrational to urge the same of the *Oscines*. Among them it is certain that not one of the three families which different systematists have selected for the post of leader is strongly represented in the New World—two of them, the *Corvidæ* and *Fringillidæ* (if we exclude the presumed *Emberizidæ*), very poorly indeed; while the remaining family, *Turdidæ*, cannot number, even at a very high estimate, one-third of its members as American. The meaning of these considerations will become plainer if we substitute for the expression "weaker and lower types" its justifiably equivalent rendering, that of "older and more generalised types." Then we shall see the important signification of the alliance we have supposed to exist between the *Icteridæ* and the *Emberizidæ*; and, moreover, a reasonable means of accounting for the remoter relationship, recognised by Mr. Sclater (Introd., p. viii.), between the *Tanagridæ* and the *Fringillidæ* on the one hand, and the *Cœrebidæ* and *Mniotiltidæ* on the other, is provided. This result, we trust, will serve to excuse these remarks, which might otherwise appear to be irrelevant; and, speculative as they are, it must not for a moment be imagined that we think the introduction of anything like them was needed or would have been expedient in such a volume as that now under notice. A reviewer may take liberties that are denied to an author.

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[1] To attempt here to account for the distribution of the non-American families of this group—*Pittidæ*, *Philepittidæ*, *Eurylæmidæ*, and *Acanthisittidæ*—would lead us far beyond the limits of our present subject.

But now to return to our proper business. In his treatment of the subject Mr. Sclater, as might be expected, shows himself its master; not but that there are a few points—and one of them we have indicated—on which he owns himself doubtful. This is no drawback, for such there are, and long will be, in every matter of this kind. One great merit, in our eyes at least, is that he steadily treads the old high-road which has conducted its passengers to so many great achievements, and refuses to follow the bewildering by-paths, of late so much vaunted by various writers, that are eventually found to mislead the unwary or inexpert traveller into bottomless bogs. A plain view of things is taken, and one that is suggested no less by eminent knowledge than by common-sense. There is no attempt to regenerate a fallen world of science within the narrow limits of a catalogue, or to make the catalogue of a single museum, however great its wealth, pass for a monograph. From the beginning of the volume to its end there does not appear the trace of a wish to indulge—may we be pardoned the word?—a "fad"; not even in the frivolous matter of nomenclature, a rock on which all novices are sure to strike, and often to split.[1] The various "keys" with which every group is provided seem always to fit and to turn easily in their locks—not, indeed, a surprising fact, since Mr. Sclater, if not the inventor, has long been one of the most skilful handlers of this convenient differentiating instrument, so useful when manufactured by an adept, and so useless when turned out by a tiro, who not seldom contrives, in the course of a few lines, so to complicate his conditions (of his own choosing, be it remembered) as to render them characterless, if not contradictory. To sum up, it may be said that, supposing the plan of the British Museum "Catalogue of Birds" to have been well laid, Mr. Sclater has shown how it may be well executed.

THE VITAL STATISTICS OF GLASGOW

The Vital Statistics of the City of Glasgow. Part II. The Districts of Glasgow. By James B. Russell, M.D., LL.D., Medical Officer of Health.

IN this Report Dr. Russell presents us with the vital statistics of the city of Glasgow and its districts for 1880, 1881, and 1882, and with some comments on, and inferences to be drawn from, the facts enumerated. Some years ago an Improvement Trust scheme for the sanitary reformation of the houses of the people was elaborated and put into operation. This scheme has achieved "a summary revolution in the worst parts of the city," not apparently before it was wanted, for Dr. Russell shows that some of the districts of Glasgow—notably that known as Bridgegate and Wynds—do not compare favourably even with the worst slums of London or Liverpool. Bridgegate and Wynds had a death-rate for 1880, 1881, and 1882, of 38·3 per thousand, a birth-rate of 37·1 per 1000, a death-rate under one year per 1000 born of 206, and a death-rate from consumption and acute diseases of the lungs of 16·75—this figure alone being higher even than the total death-rate of many English towns. Much of this district has been improved off the face of the earth—the population in 1881 was 7798, in 1871 14,294—still the houses that are left "are radically bad, and total demolition and destruction is the only remedy." It is such districts as these that have, as Dr. Russell remarks, "been the heartbreak of successive generations of Glasgow philanthropists." The death-rate of the city of Glasgow, as a whole, for 1880, 1881, and 1882, was 25·2 per 1000, with a birth-rate of 37·3 per 1000; although considerably less healthy than London, Glasgow compares favourably with Dublin, and stands on about the same level as Liverpool and Manchester. The death-rates of the different districts of the city in 1871–72—prior to the improvement schemes—are compared with those in 1880, 1881, and 1882, subsequent to the carrying out of many improvements in unhealthy areas by demolition and reconstruction. The comparison shows that in all the districts the general death-rate and the death-rate under five years (with one exception) were much lower in the latter period than in the former. "This result," Dr. Russell remarks, "is important, as proving that the displacement of the inhabitants of the central parts of the city has not deteriorated the health of the districts into which they have removed. It was proved by special investigation that the people whose wretched houses were demolished by the Improvement Trust distributed themselves over the city. It is often said that the habits of these people are such that, go where they please, they will not be the better of the change. It is evident, however, that they found physical conditions so much more conducive to health that, whether or not their habits have been improved, undoubtedly their health has been, in their new residences. The moral is to persevere in the destruction or improvement of the houses of the people. The certain result is to improve their health."

The influence of overcrowding on mortality, and the connection subsisting between overcrowding and an Irish population are well shown in the contrast between two of the districts. Blythswood is remarkable as having the lowest proportion of inmates per inhabited room, the largest proportion of large-sized houses, the lowest death-rate, the lowest birth-rate, the lowest mortality under five years, the lowest proportion of deaths under one year per 1000 born, and the lowest proportion of Irish-born of any district in Glasgow. Bridgegate and Wynds, on the other hand, has the largest proportion of inmates per inhabited room, the largest proportion, save one, of one-apartment houses, the highest death-rate over all, the highest death-rate under five years, the largest proportion of deaths under one year per 1000 born, and the highest percentage of Irish-born inhabitants. And in general, Dr. Russell states it to be a fact "that a district which has houses occupied *above* the standard number of persons per room (*i.e.* above the mean number of the whole

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[1] Indeed, we think we should have ground for complaining that Mr. Sclater has not made one nomenclatural change. He is of course as well aware as any one that the idea of a generic type never occurred to Linnæus, though it was ever present with Brisson. Nevertheless, modern specialists are required to find a type for every Linnæan genus; and, despite the almost universal practice, the type of *Tanagra* (which is only Brisson's *Tangara* with a modified spelling) is clearly *T. tatao*. Moreover, the generic term *Calliste*, used by Mr. Sclater for that species and its congeners, is but questionably admissible from its prior application by Poli ("Test. utr. Siciliæ," i. p. 30)—in a different dialectical form (*Callista*), it is true; but the Goddess of Wisdom may be called to witness that her name, whether written Athen*e* or Athen*a*, is one and the same; while we ask her pardon and that of our readers for drawing attention to such a trifle.